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Redistributive Effects of Transfer Programmes in the United Kingdom

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We discuss the redistribution effects of transfer using a conditional-choice general equilibrium model. We calibrate it to UK data for the early 2000s. Results indicate that a money-metric measure of the welfare value of transfer received by the bottom decile of UK households equals 17% of the cash transfer.

INTRODUCTION

Most empirical work that seeks to assess the redistributive effects of transfers paid to lower-income households (AFDC in the United States; income and housing benefit in the United Kingdom) assumes that recipient households are made better off by the full amount of net cash transfers received (net of any tax-back), with wage and other behavioural responses largely ignored.[1]

Considerable energy is devoted in some of this literature to calculating and modelling the complex tax-back schemes that accompany these transfers, with implicit tax rates varying by household and income characteristics, discontinuities and spikes appearing in tax rate profiles, and other complex institutional features captured. However, as an extensive older review of the then available work on transfer programmes by Danziger *et al*. (1981) says, 'the redistributive effect of transfers is generally measured by comparing pre-transfer and post transfer income distributions. This comparison assumes that transfers elicit no behavioral response that would cause income without transfers to deviate from observed pre-transfer income'.[2] Subsequent and more recent work in this area, e.g. Dickert *et al*. (1994), Moffitt (1992) and Hoynes (1993), have focused on partial equilibrium labour supply impacts of transfer programmes, but with only limited attention to impacts on other endogenous variables, including welfare and wage rates. (See Creedy and Kalb 2005 for a more recent review of partial equilibrium literature, including some attempts to compare changes in disposable incomes to changes in ability.)

The point of departure in this paper is the observation, which seems not to have appeared in the literature,[3] that, with voluntary participation in transfer programmes (with tax-back or withdrawal provisions), the utility, or real income, value of transfers to participants is typically less than the cash transfers received. If impacts on wage rates are ignored for the moment, individuals (or households) compare utility across two regimes: one with benefits and tax-back arrangements, and the other with no benefits and no tax-back, choosing the higher-utility regime. A money-metric utility comparison between the regimes (the real income difference) bears no direct relation to the net of tax-back cash transfer actually received. Indeed, in the extreme case where an individual (or household) is indifferent between participating and not participating, if they were recorded as a benefit programme participant, the real income gain to them from participation in the transfer programme would be zero, despite the disbursement of public funds to the recipient. We therefore argue that in general, and ignoring wage rate effects, the real income received by transfer recipients is smaller than the cash transfers actually made, since to the recipient the reference point for valuing them should be the reservation utility in the no benefit–no tax-back regime.[4]

Given tax-back rates, individuals (or households) also will not participate in transfer programmes until some threshold level of transfers is reached, raising utility under participation above that in the no-participation regime. Tax-back conditions in benefit programmes thus impose a form of real-income entry fee on participation, which must be deducted in evaluating the redistributive effects of transfer programmes. Conditional on participation, transfers shift recipients' budget constraints in parallel. In the homothetic case, after the entry fee has been paid marginal increases in transfers (for fixed tax-back rates) provide recipients with corresponding marginal increases in real income in the fixed-wage case. Hence we also argue that the average value of transfers (gain per £1 of transfers received) will typically differ from the marginal value (the extra benefit per additional £1 of transfers) to recipient households.

We further argue that an additional effect, also seemingly missing from existing literature, needs to enter analyses of the redistribution effects of transfers: namely, that when the poor participate in a conditional transfer scheme, the associated withdrawal of low-wage labour from the market place drives up the wage of low-wage(skill) workers relative to high-wage (skill) workers. Thus, with the heterogeneous labour by income (skill) range, the withdrawal of low-wage labour resulting from high tax-back conditional transfers to the poor raises their wage rate. This set-aside effect thus potentially raises the welfare of the poor, and actual redistribution to the poor through transfers may be underestimated for the reasons given above.[5]

We use conditional-choice general equilibrium models to assess the importance of these two effects. These models embody both endogenous participation decisions in transfer schemes by households and heterogeneous labour in production (by income range or skill type). In such models programme participation by low-income households is endogenously determined in equilibrium along with the wage distribution, since wage rates change as transfer programmes characteristics (benefit levels, tax-back rates) change.

In these models the budget sets for households are also non-convex, presenting special computational problems that have not been tackled, as far as we are aware, in existing general equilibrium tax computation literature. Commodity demands by households, including leisure, are no longer analytic, even for conventional CES or Cobb–Douglas utility functions. This means that household demands have to be evaluated numerically using optimization techniques within a larger equilibrium structure, including the production-side modelling of the economy. In essence, in such models solution procedures use optimization embedded within wider consistent optimization, since consumer demands are non-analytic.

We first present numerical examples which illustrate the potential significance of the two features we highlight as missing from existing literature. We then apply our techniques to an assessment of the redistributive effects of UK transfer programmes using 2000/01 data. Relative to previous literature on assessments of benefit programmes, our model results show that the welfare (or utility) value of transfers received differs markedly from their cash value, in our central case specification being lower by a factor of around 2. Model results also show that incorporating heterogeneous labour in production adds an important and neglected channel for distributional effects from conditional transfer programmes to operate through the induced withdrawal of lower-income labour from the market, since this increases the wage rates of low-wage labour. The strength of this effect depends crucially on the elasticity of substitution in production, which we relate to literature estimates. This can reduce the tax cost of marginal real income transfers to the poor, since induced wage rate changes reinforce the redistribution effect. These two features emerge under most model parameterizations, including those calibrated to the skill-specific labour demand elasticity estimates reported in Hamermesh (1993). These are used in model calibration for cross elasticities of substitution among labour types in production.

The conclusion we offer is that assessment of the redistributive effects of conditional transfers is not as straightforward as it appears at first sight; nor does the real income value of such transfers seem to be as large as is implicitly assumed in the literature. Regime choice significantly affects such measures, and their general equilibrium effects through programme-induced low-wage labour withdrawal need to be taken into account. These effects seem to be absent in available literature in the area, and are important because they can change perceptions regarding the redistributive effects of transfers. We offer our conditional-choice general equilibrium model as a way forward, and investigate these effects using UK data.

I. A Conditional-Choice General Equilibrium Model for Analysing the Redistributive Effects of Transfers

Background

As we note in the Introduction, when analysing the redistributive effects of transfers the conventional treatment in the literature is to assume that recipients of transfers are made better off by the cash value of the transfers they receive. The welfare effects of programme conditionality through tax-back and other arrangements are ignored, as are the impacts of transfers on high and low-skill wage differentials through induced low-wage labour withdrawal from the market.

These two effects seem to be ignored in existing literature; but there are related ideas that have been discussed, and it is perhaps worth clarifying further our point of departure. In essence, we argue that transfers should be valued to recipients using their reservation utility in the no-transfer regime as the reference point. This differs from the value of cash actually received. Some literature (Brown 1980; Betson and van der Gaag 1985; Betson and Greenberg 1986; Greenberg 1997) has attempted to make adjustments to measured redistributive impacts of transfers for the value of leisure to transfers recipients, but this is a different notion from that we advance here. Also, wage rate endogeneity in the presence of changes in transfer programmes may seem an obvious point, but the existing literature lacks any treatment of these effects, in part owing to the problems of analytically formulating and solving market-clearing equilibrium models with endogenously determined wage distributions.

It is also worth emphasizing that, for simplicity, we treat participation in transfer programmes as being based solely on welfare considerations. In so doing we ignore transaction costs, sigma effects from participation, informational inadequacies and intertemporal considerations that motivate analyses of non-participation in Strauss (1977), Fry and Stark (1987), Moffit (1983), Blundell (1988), and Blank and Ruggles (1996). Q6

In our formulation, the effects of programme conditionality on both participation decisions and the valuation of the benefits of transfers reflect a regime choice problem. If p and w denote the consumption good price and the wage rate, and if household utility evaluated at given benefit and tax-back levels is U_B, and with no benefits and no tax-back is U_{NB}, then if

$$(1) \qquad UB(p, w) > UNB(p, w),$$

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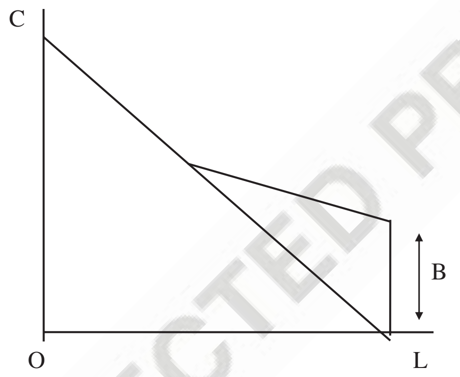
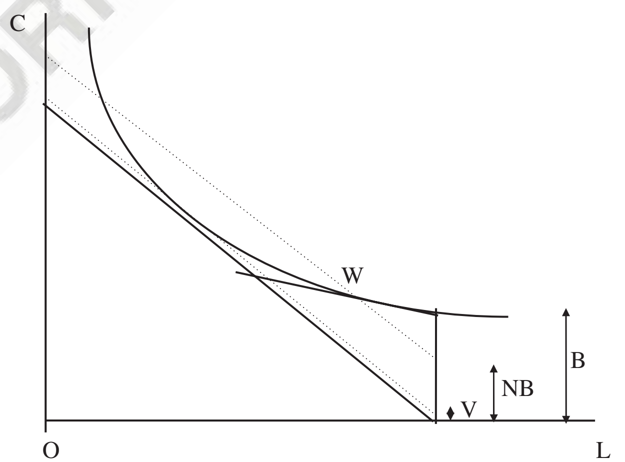
the household participates in the benefit programme. However, the value of the transfers to the household is a money-metric measure of the difference ($U_B - U_{NB}$), not the level of cash benefits actually received. The real income gain from a marginal increase in benefits (where the benefit level B increases to B') will, however, be more closely related to the benefit change. In the homothetic case, the money-metric measure of the real income gain fully reflects the marginal gain from transfer increases of ($B' - B$), assuming that the household participates in the programme at a benefit level B.

These valuation features of conditional transfer programmes are illustrated in Figures 1 and 2. Figure 1 displays the budget set in the presence of conditional transfers. The household decides its consumption/leisure choice, given a fixed wage w, but is also offered participation in a transfer programme which pays a fixed benefit B; while taxes apply to any additional labour income at some (typically high) tax-back rate, t_B. The



C = Consumption ; L = Leisure ; B = Transfer.

FIGURE 1. Non-convex budget set in the presence of conditional transfers



W = Consumption / Leisure point under programme participation
B = Benefit paid
NB = Net benefit paid (after tax back)
V = Money metric measure of the value of net transfers received

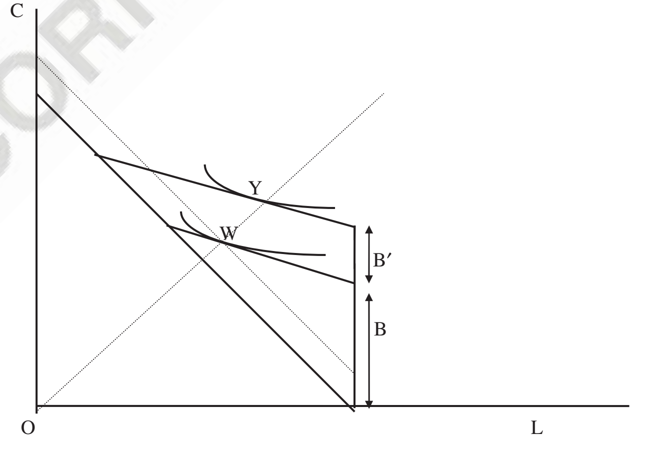
FIGURE 2. Participation choice and the value of conditional transfers

budget set for the household in the presence of these features is no longer convex, being given by the intersection of the no-transfer budget and the with-transfer budget constraint.

Figure 2 displays the valuation of transfers. The household participates in the transfer programme, receiving B, but faces a tax-back rate on additional labour income to yield a net benefit of NB; consuming at point W. The utility value of programme participation, however, is smaller than NB because the point of comparison is utility in the no benefit - no tax-back regime. In money-metric terms, participating in the transfer programme yields a gain of V rather than NB. Thus, studies of the redistributive effects of transfers that show households as gaining from transfers by the amount of cash received (receiving NB on a net basis) overestimate their redistributive effects, since in utility terms the household receives a smaller real benefit from participating in the programme. In the extreme case where the household is indifferent between participating and not participating but chooses to participate, there is no gain, despite the disbursement of funds involved.

Figure 3 illustrates the impact of a marginal increase in transfers when the wage rate remains unchanged. Conditional on participating in the transfer programme, if the household receives an increase B' in benefits under the programme, and if preferences are homothetic, consumption will move along a radial expansion from the origin from W to Y. Real income will also increase by B', and at the margin the real income gain will equal the incremental transfer. Thus, the marginal and average value of transfers to recipients differ. Conditional upon participating in a transfer programme, the real value of additional transfers equals their cash representation, but the average value of all transfers received will be below their cash value because of the tax-back features of these programmes.

The effect of conditional transfers on the wage distribution noted above is another factor that is ignored in the existing literature, both because of the widely used partial equilibrium assumption that wage rates for transfer recipients remain unaffected by the



B = Original transfer
B′ = Increase in transfers
W = Original equilibrium point for transfer recipients
Y = Equilibrium with additional transfers, B′

FIGURE 3. The impact of a marginal increase in transfers

introduction of transfer programmes, and because of the lack of availability of market-clearing equilibrium models with heterogeneous labour in which the wage distribution is endogenously determined. However, because of the high tax-back rates in transfer programmes, as participation occurs low-wage labour withdraws from the market place, bidding up its own wage rate and amplifying whatever redistributive effect of transfers occurs in a traditional partial equilibrium model.

In the conditional-choice general equilibrium model used here to value the redistributive impacts of transfers, in contrast to available literature wage, rates across the heterogeneous labour types are endogenously determined. We assume that production in the economy involves a single output and heterogeneous labour inputs, that profit-maximizing behaviour yields labour demand functions by skill type, and that as a result wage rates by skill type are endogenously determined rather than given.[6] In this framework, conditional transfers result in the withdrawal of low-skilled labour from the market relative to a no-transfer programme regime, and the supply function of low-skilled labour shifts. Conditional-transfer programmes thus can have the further redistributive effect of raising the wage rate of low-skilled labour through conditionality-induced labour withdrawal from the market place. This effect can also play an important role in determining the distributional impact of transfer programmes, and is analysed here alongside the first effect noted above.

A conditional-choice general equilibrium model

We use a general equilibrium model with both transfer participation choice by households and endogenous wage determination by skill type. We numerically solve the model both where transfers and associated tax-back arrangements are present and where they are absent. This allows for a comparison of the redistributive effects of transfer programmes based both on conventional analyses and on the modelling approach set out above, which captures the two effects missing from previous literature. We later present analyses of model-generated estimates of average and marginal redistributive effects of transfers using UK data.

Essentially, we develop a conditional-choice general equilibrium model as an extension to the standard general equilibrium tax model set out in Shoven and Whalley (1973, 1992). The main departure from the traditional model is that, with non-convex budget sets, household demand functions, including those derived from conventional functional forms such as CES or Cobb–Douglas, are no longer analytic. Demands thus need to be solved numerically and embedded within a larger equilibrium problem, rather than derived algebraically, as is usually done. We use GAMS optimization code for this purpose, with numerical (rather than analytical) solutions of household optimization sub-models generating demands and communicating with a master economy-wide equilibrium formulation, which includes production. The production modelling explicitly incorporates heterogeneity among labour inputs, with skill levels assumed to be collinear with income ranges.

The implications of nonlinear budget constraints for the estimation of labour supply elasticities have been extensively discussed in the literature (see Hausman 1981; Heckman 1974), but less attention has been given to the impacts of non-convex budget sets on the welfare and redistributive impacts of transfer programmes. These pose the special problems of (i) potentially multiple solutions to household optimization problems, (ii) discontinuities in responses to wage rates and transfer programme characteristics such as households change regimes, and (iii) local rather than global optima being found by numerical optimization packages used in any simulation analysis.

Using the two-household (high and low-wage) case for illustrative purposes, we consider a model with a single commodity (consumption good) and two labour (leisure) types. Distorting income taxes collected from the high-wage household finance transfers to the low-wage household. In the presence of a household income tax at rate t_1, a transfer programme with eligible benefits B and a tax-back rate of t_2 (significantly higher than t_1), demand functions for the consumption good are obtained by solving an optimization problem for each household (i.e. for each of the high and low-wage types). These optimization problems can be written as

$$\text{(2)} \qquad \max U_i(C_i, L_i^e) i = (H, L)$$

subject to

$$\text{(3)} \qquad P_c C_i = \max\left[\left\{w_i(1-t_1)(\overline{L_i} - L_i^e) + R_i\right\}, \left\{w_i(1-t_2)(\overline{L_i} - L_i^e) + B_i + R_i\right\}\right],$$

where C_i and L_i^e are the consumption of goods and leisure by household i, P_c is the price of the consumption good, $\overline{L_i}$ is the household labour endowment[7] and w_i is the wage rate applying to the labour type i, which in turn is specific to the ith household type; R_i defines that portion of aggregate tax revenue (net of transfers) that is redistributed to household I, and household (non-transfer) income I_i is given by the maximal portion of the budget constraint (3). In the determination of household demands the R_i are taken as parametric; but in equilibrium, when summed across households, these must equal the revenues actually collected by the government. These household utility maximization problems mirror those represented diagramatically in Figure 2, with the choice between the two regimes entering for each household.

We represent production in the model though a production function defined over the consumption goods and the two types of labour inputs:

$$\text{(4)} \qquad C = F(L_H, L_L),$$

where C defines aggregate consumption, and L_H and L_L are labour inputs supplied by high and low-wage households.

Explicit labour income taxes, or tax-back rates, accompany the transfer programme and affect the price of leisure in terms of consumption goods on the expenditure side of the budget constraint (3) for each household. In equilibrium, the aggregate production must equal the sum of consumption demands across households and labour markets must clear;[8] i.e.,

$$\text{(5)} \qquad C = (C_H, L_L),$$

$$\text{(6)} \qquad \overline{L}_H = L_H^e + L_H,$$

$$\text{(7)} \qquad \overline{L}_L = L_L^e + L_L.$$

The goods price and wage rates are thus endogenously determined such that in equilibrium the goods and labour markets clear (equations (5), (6) and (7)), and the solutions to the (non-analytic) optimization problems (2) for each household yields solutions L_L^*, L_H^*, which correspond to optimizing factor input use in production. Wage rates are thus endogeneously determined to clear labour markets; and the model is homogeneous of degree zero in wage rates and prices, so that either the consumption good price or one of the wage rates can be taken as the numeraire.

Set up in this way, tax rates (income and tax-back rates) can be exogenous in the model, as in the original Shoven–Whalley formulation, and with the revenues (net of expenditures on transfer programmes) dispersed to households endogenously determined. Alternatively, R can be set exogenously, and the income tax rates endogenously determined (with the tax-back rates exogenous) to meet a given net of transfer revenue requirement. An $R = 0$ case arises when the income tax revenue raised from non-transfer participants exactly finances the transfers dispersed.

In equilibrium, the government budget balance must hold. This can be written as

$$\text{(8)} \qquad \sum_{i=H,L} B_i N_i + \sum_{i=H,L} R_i = \sum_{i=H,L} (1 - N_i) t_1 w_i L_i + \sum_{i=H,L} N_i t_2 w_i L_i,$$

where N_i is an index for household i, which takes the value 1 if household i participates in the conditional transfer programme and 0 otherwise. The first right-hand side term reflects income taxes at a rate t_1 on household income. The second term denotes revenues from tax-backs at a rate t_2 applied to transfer programme participant households; this is not collected from non-benefit programme participants.

In this equilibrium structure, household budget sets are non-convex and optimizing behaviour cannot be represented by a series of first-order conditions from utility maximization. Household optimization problems therefore have to be solved numerically to yield household demands, and a separate numerical evaluation of household optimization problem is needed; but this must take place at the economy-wide prices associated with the equilibrium. Equilibrium models of this form, with heterogeneous labour inputs and a single output in production, have not been widely used in the numerical equilibrium tax literature, where it remains common to work with homogeneous labour in production.

We use the GAMS (Generalized Algebraic Modelling System (Brooke *et al.* 1992) optimization software for this purpose, since this is now widely used by equilibrium modellers and is thought to be the most suitable optimization code available. The regime choice formulations we adopt are surprisingly difficult to solve numerically, and we use the PATH solver developed by Dirkse and Ferris (1995) to solve the models that follow, since more conventional GAMS solvers (Conopt, Minos) fail. Because of the non-convexities in the household budget sets, at any computed equilibrium we also check optimizing outcomes for each household in both regimes, in order to confirm that a global rather than a local solution to each sub-optimization problem has been found.

Once in place, this numerical structure can be used in counterfactual equilibrium mode as set out in Shoven and Whalley (1973), first with calibration of the model structure to a base-case equilibrium, then by counterfactual equilibrium computation under a change in model specification (such as the level at which benefits are paid). Calibration also provide a test of the model's ability to replicate the base-case equilibrium. These procedures enable the comparison of equilibria with and without benefits, and calculations of the redistributive effects of transfers.

A simple numerical example

Table 1 provides a small-dimensional example which we have used to evaluate the redistributive effects of conditional transfers in an artificial economy using the model set out above. The parameter values and functional forms used are illustrative rather than realistic, but none the less serve both to show how the model can be applied and to underline the central themes of the paper. We use CES preference and production

TABLE 1

A SIMPLE NUMERICAL EXAMPLE ILLUSTRATING THE EVALUATION OF THE REDISTRIBUTIVE EFFECTS OF TRANSFER PROGRAMMES USING CONDITIONAL CHOICE GENERAL EQUILIBRIUM MODELS

No. of labour types	2 (high-wage and low-wage)
Preferences	CES with shares 0.86, 0.14 on consumption/leisure for low wage CES with shares 0.54, 0.46 on consumption/leisure for high wage CES with substitution elasticities 1.5 for low wage, 1.5 for high wage
Production	CES production function with share parameters of 0.24, and 0.76 low and high-wage labour. The substitution elasticity in production is set at − 1.55. The unit term in the CES function (which controls the position of production function) is set at 1.3. Labour endowments are 40 and 60 for low and high income households.
Tax rates	Income tax rates: 0.4 for high wage and 0.0 for low wage Benefit tax back rate: 0.8 for both households
Benefit levels	11 for the low wage worker who participates in the transfer programme (in the with benefit case).
Revenue distribution	Low and high-wage households receive 2.3 and 7.4, resp., of the net revenues (tax revenues less transfers paid) as a lump-sum redistribution.

The above parameters are derived from the following set of baseline data with low and high income households:

	Low-income household	High-income household
Gross income	10	20
Benefit	11	0
Transfer	2.3	7.4
Income tax	0	8
VAT	1.3	3.4
Tax back	8	0
Gross consumption	14	16
Leisure	30	40
Labour endowment	40	60

functions, with specified share and elasticity parameters, and a high tax-back rate of 80 percent.

Section (a) of the table sets out the specification used in the example using data in section (b) of the table. There are two labour types, each with CES preferences defined over consumption and leisure. Elasticities in preferences are 1.5 for each household. On the production side, we specify share parameters for each labour type as well as a single elasticity of substitution, which is equal to 1.55. Being greater than 1, this elasticity implies that the wage of low-wage labour falls sharply as transfers are eliminated. The income tax rate for the high-wage household is 0.4, and there is 80% tax-back rate in low-income households.

Tables 2 and 3 report model-generated equilibria in both the presence and absence of transfers: prices, goods consumption, leisure consumption, taxes and benefits and welfare are all displayed. Table 3 indicates that if transfers are abolished the high-wage

Table 2

Model Equilibria with and without Conditional Transfer Programmes for the Numerical Example Specified in Table 1

(a) *Equilibrium in the presence of transfer programme*

Prices	Consumption good	1.00	Regime choice	High wage does not participate in transfer programme.	
	High wage	1.00		Low wage participates in transfers programme	
	Low wage	1.00			
Consumption	Consumption by high wage	15.8	Taxes/transfer	Total tax revenues collected	20.6
	Leisure of high wage	40.0		Transfers paid	11.0
	Consumption by low wage	14.0		Net tax revenue redistributed	9.6
	Leisure of low wage	30.0			
Welfare	Utility high wage	51.0			
	Utility low wage	27.7			

(b) *Equilibrium in the absence of transfer programme*

Prices	Consumption good	1.00	Consumption	Consumption by high wage	48.9
	High wage	1.6		leisure of high wage	28.4
	Low wage	0.50		Consumption by low wage	17.2
				Leisure of low wage	8.9
Welfare	Utility high wage	76.3	Taxes/transfer	Total tax revenues collected	12.0
	Utility low wage	24.4		Transfer paid	0.0
				Net tax revenue redistributed	12.0

household gains because taxes are no longer paid to finance transfers, and the low-wage group loses. However, losses in real income for the low-wage are only 25.4% of the cash transfers, which terminate with the elimination of the transfer programme, despite a fall in the relative wage of the low-skilled. The evaluation of programme impact implied by these model results thus differs sharply from that derived from a more conventional calculation, which simply measures cash benefits paid and nets out taxes collected through tax-back arrangements, with the net payment taken as the benefit to the transfer recipient.

II. Assessment of the Redistributive Effects of Government Transfers in the United Kingdom

We have also used the framework set out above to investigate the implications of our conditional-choice general equilibrium model for more empirically based assessments of the redistributive impacts of tax-financed government transfer programmes. We base our analyses on data produced annually by the UK Statistical Office (Office of National Statistics/ONS) and published in *Economic Trends*. In this, taxes paid and benefits received both from direct transfers and from other selected government expenditures are

TABLE 3
COMPARING MODEL-BASED AND CONVENTIONAL EVALUATIONS OF THE REDISTRIBUTIVE EFFECTS OF TRANSFER PROGRAMMES USING THE EXAMPLE FROM TABLE 1

(a) *Model evaluation of the effects of eliminating transfers programme*

		High-wage household	Low-wage household
Hicksian EV		49.6%	– 11.9%
Hicksian CV		– 33.3%	13.6%
Wage rate changes under programme elimination	High/low wage rate ratio before benefit elimination		1.00
	High/low wage rate ratio after benefit elimination		3.09

(b) *Conventional evaluation of redistributive impact of transfers*

Gross cash benefits received under programme by low wage household	13.3
Taxes paid by low wage household through tax back	8.0
Net benefit received by low wage household	5.30
(c) *Ratio of money metric welfare loss to low wage from transfer elimination to loss in net cash benefit*	25.4%

allocated to deciles of the household population. We use the data for 2000/01 (*Economic Trends*, April 2001) as the starting point for an analysis of the redistributive effects of transfers using the conditional-choice general equilibrium framework set out above.

We take these data, after some elaboration and adjustment for mutual consistency, as representative of a base-case economy wide equilibrium. We calibrate a ten-household version of our conditional-choice general equilibrium model to these data, with the ten households reflecting the UK household decile groups reported in the ONS data. We use data only on non-retirees, to avoid including redistribution through public pensions in our analyses, since for these there is no endogenously determined participation decision. We perform counterfactual analyses similar to those reported for the numerical example above, including removal of and incremental increases in cash transfers. In so doing, we incorporate literature estimates on benefit tax-back rates and on labour supply (leisure demand) and labour demand elasticities (the substitution of various types of labour in production).

Base-case data

The main source for our base-case data is *Economic Trends* (April 2001), which reports components of income for non-retired households grouped by income decile,[9] and benefits received and taxes paid for each household decile for the UK tax year 2000/01. We use these data to construct a model-admissible data-set for an analysis of the redistributive effects of transfers in the United Kingdom incorporating endogenous participation decisions. 'Original income' in these data is taken as the value of non-leisure production in the model-admissible data-set; non-contributory benefits give net benefits paid to households in the base year; benefits in kind plus contributory scheme benefits are summed to yield non-conditional benefit-related transfers which are treated in the model as paid to households in lump-sum form. We separate direct taxes, which can be avoided by not working (i.e. consuming leisure), from indirect taxes, which must still be paid on transfer-financed consumption even if the household does not work. These are grouped, after adjustment for micro consistency, under broad headings, with the constituent elements for each as displayed in Table 4.

To yield a model-admissible data-set for calibration purposes, a series of further adjustments are made to the base-case data.

1. *Government budget balance*. Government budget balance does not hold in the base 2000/01 data available from UK government sources, whereas this is a property of equilibrium in the model. In part, this is because not all government expenditures (such as defence) are induced in the *Economic Trends* data. To achieve budget balance, we proportionally scale all taxes across all deciles in the unadjusted base-case data so that this is the applies. This is one of several scaling adjustments that can be used to satisfy this requirement of model admissibility.
2. *Netting out benefits and income taxes*. In our model representation, households receiving benefits (net of tax-back) cannot pay personal income taxes in addition to paying the tax-back on benefits. But in the unadjusted data for 2000/01 coexisting income tax payments and transfer receipts do occur, because each decile consists of an aggregation across different households within the cell. We net out these receipts and payments for each cell, so that each household decile is either a net payer of income taxes or a net recipient of benefits. After this netting out, 3 out of 10 household groups receive net benefits in the data used in the model, while 7 out of 10 household groups are net payers of income taxes.
3. *Setting model tax rates*. We calculate both income and indirect tax rates by decile, using unadjusted raw data and assuming that average and marginal tax rates for any household within a decile grouping are the same for all households within the group. We set model tax-back rates on additional labour income for the transfer recipients at 80%. This is lower than the combined 75% withdrawal rate on income support and 20% rate on housing benefit that typically apply in the UK. In reality, and as Dilnot and Duncan (1992) document, tax-back rates vary significantly across households, depending upon household characteristics and on how both programmes and income sources interact. We abstract from these complications here by setting a single and common tax-back rate in the model across all household deciles receiving transfers.
4. *Adding leisure consumption*. To incorporate leisure consumption into the base-case data used in the model, we use UK time use survey data reported in Dex (1995). These data do not directly provide time use data by income range, and we supplement this with further information on hours of work by decile. The way in which these data are used is reported on in Table 4 and the associated footnotes (especially the definition of the value of leisure).
5. *Elasticities*. The two key elasticity parameters in the model are the CES substitution elasticities in consumption and production. We calibrate values of these elasticities so as to be broadly consistent with implied literature values of labour supply (and hence leisure demand) elasticities used in household CES preferences, and of labour demand elasticities implied by the elasticity specification in the CES production function. We use Killingsworth (1983) as our main source of labour supply elasticities, and Hamermesh (1993) for labour demand elasticities. We use a substitution elasticity in preferences of 1.5 for all household groups, which implies a point estimate of the aggregate labour supply elasticity in the neighbourhood of the base-case equilibrium

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TABLE 4[1]

BASE-CASE 2000/01 UK DATA FOR HOUSEHOLD DECILES ON HOUSEHOLD INCOMES, TAXES, AND TRANSFERS IN £/YR PER HOUSEHOLD

Household deciles	Original income	Non-con-tributory benefits	Direct cash benefits	Direct tax	Indirect tax	In-kind transfers	Earnings per week	Working weeks	Value of leisure	Total income	Consumption
Poorest H1	2,149	4525	469	930	2139	4647	160	13	14,491	16,640	8,721
H2	4,724	4866	782	1,194	2183	4007	210	23	17,085	21,809	11,002
H3	9,141	3510	963	1,880	2759	3765	223	41	14,076	23,217	12,740
H4	13,296	2745	746	2,815	3213	3561	243	55	11,934	25,230	14,320
H5	17,353	2027	704	2,831	3572	3266	272	64	10,895	28,248	16,947
H6	21,416	1653	603	4,745	3957	3276	306	70	10,455	31,871	18,246
H7	24,609	1348	522	5,531	4266	2755	355	69	12,293	36,902	19,437
H8	28,038	1037	447	6,576	4362	2304	403	70	13,895	41,933	20,888
H9	33,743	788	386	8,175	4537	2189	473	84	8,190	41,933	24,394
Richest H10	56,065	778	301	15,082	5551	1826	543	91	6,871	56,420	31,831

Notes
This table is derived from Table 9 (Appendix 1) of *Economic Trends*, April 2001, p. 63.
Original income includes wages and salaries, imputed income from benefits in kind, self-employment income, occupational pensions, annuities, investment and other income.
Non-contributory benefits include income support, child benefit, housing benefit, invalid care allowances, attendance allowance, war pension and war widows pensions, disability living allowance, industrial injury disablement benefit, student maintenance awards, government training schemes, family credit and other non-contributory benefits.
Direct cash benefits consists of contributory retirement pension, unemployment benefit, invalidity pension and allowance, sickness and industrial injury benefit, widow's benefits, and statutory maternity pay/allowance.
Direct taxes include employees' national insurance (NI) contributions.
Indirect taxes include taxes on final goods and services, VAT, duty on tobacco, beer and cider, wines and spirits, hydrocarbon oils, vehicle excise duty, TV licences, stamp duty on house purchase, customs duties, betting taxes, insurance premium tax, fossil fuel levy, air passenger tax, Camelot national lottery fund. It also includes intermediate taxes such as commercial and industrial rates, employer's NI contributions, duty on hydrocarbon oils, vehicle excise and other duties.
Benefits in kind consist of education, national health service, housing subsidy, rail travel subsidy, bus travel subsidy, school meals and welfare milk.
Earnings per week for top and bottom deciles, and first and third quartiles, are taken from the New Earnings Survey 2000. These are interpolated for other deciles.
Working weeks are derived by dividing the original income by the weekly earnings.
The *value of leisure* is obtained by multiplying non-working weeks by the weekly earnings rate. The number of non-working weeks is the difference between the working weeks and 104 weeks, which represents the total labour endowment per household with two working members.
Original income plus the value of leisure gives the total income of the economy.
Consumption for a household is derived by adding cash, in-kind and non-contributory benefits to original income and subtracting the direct and indirect taxes paid by the household.
Source: Based on Table 9 (appendix 1) of Economic Trends, 2000/01, p. 63, and authors' own calculations. Further explanatory notes are given over.

of 0.23 (within in the range suggested by the studies reviewed by Killingsworth). We use a substitution elasticity in production of 1.5 as our central case, which yields a point estimate of the demand elasticities for individual labour categories of between -1.05 and -1.5 in the range of skill-specific labour demand elasticities suggested by Hamermesh. The wage rate effects in the model are sensitive to the setting of this elasticity, and a value close to unity yields almost no wage rate effects, enabling us to use a model specification with an elasticity in production of unity to abstract from wage rate effects. We thus use two base cases, one with wage rate effects present (elasticity of 1.5) and one with them absent (elasticity close to 1).

Model experiments and results

To use the above-described model to evaluate the redistributive effects of transfers, we perform counterfactual analyses with the model. We first calibrate the model to the base-case 2000/01 data. We then compute equilibria in which we remove both benefits and tax-back arrangements, and make further small adjustments necessitated by the government budget balance condition in the model.

The government budget constraint in the model can be written as

$$\text{(9)} \qquad \sum_i B_i + \sum_i Tr_i = VAT + IT + TB,$$

where B_i and Tr_i are benefit payments and other transfers received by household i and VAT, IT and TB represent the collections of indirect taxes, income tax and tax-back arrangements.

If we eliminate benefits paid to each household (B_i) and all tax-back arrangements (TB), then, if we wish to maintain other transfers to households (Tr_i) at their base levels, some further change is needed in the model to satisfy the budget balance condition (9). Just as in tax incidence analysis, where the incidence effects of a tax cannot be discussed independently of the replacement regime (e.g. no replacement tax, or an equal-yield sales/income or other tax), in discussing the redistributive effects of transfers, what happens to the rest of government activity must be carefully specified and can affect conclusions.

When the B_i and associated TB are eliminated, we keep other (non-benefit) transfers to each individual household (Tr_i) constant in real terms. This means that benefit-recipient households suffer the full real income loss from the termination of benefits. To achieve government budget balance in the new equilibrium, we proportionally scale all income tax rates for non-participants so that this condition holds in the counterfactual equilibrium. The only direct effect of government policy changes on recipient households from the experiment is their loss of benefits.

Using both the model and the constructed micro-consistent data-set, we performed experiments similar to those undertaken for the simple numerical example reported earlier. Here, however, we produce two cases: one using a production-side substitution elasticity, for which the wage-rate changes across deciles are small, and one for a higher literature-based elasticity, for which the wage rate effects are substantial.

The results, reported in Table 5, confirm the themes suggested both by the line of argument of the paper and by our numerical example: namely, that valuing the redistributive effects of transfers in terms of their cash value to recipients is misleading. In case 1, where the choice of substitution elasticity in production (1.05) produces a large wage-rate effect, for the bottom three deciles of UK households the losses in real income

TABLE 5
THE REDISTRIBUTIVE EFFECTS OF TRANSFERS IN THE TEN DECILE CONDITIONAL CHOICE GENERAL EQUILIBRIUM MODEL CALIBRATED TO 2000/01 UK DATA

	Case 1 Production elasticity set close to 1: small wage rate effects		Case 2 Production elasticity at 1.5: larger wage rate effects	
Deciles receiving benefits in the base case	Ratio of real income loss from transfer elimination to cash benefits forgone	% change in wage rate of group	Ratio of real income loss from transfer elimination to cash benefits forgone	% change in wage rate of group
Bottom decile	0.17	– 54.4	0.168	– 54.7
Next-to-bottom decile	0.15	– 53.9	0.148	– 54.3
Third decile	0.21	– 45.8	0.211	– 47.3

Note: We use a value of 1.05 since computational problems arise as this elasticity asymptotically approaches 1.

when all benefits are eliminated fall well short of the direct losses from benefit elimination: only 17% of the value of net cash transfers withdrawn is lost in real-income terms for the lowest group; the second group loses only 15% of net cash benefits, and the third group loses 21%. These ratios fall or rise by decile depending upon the rate of substitution across various categories of labour in production. As argued earlier, with an implicit entry fee being paid by participants in transfer programmes via comparison with the reservation utility, the smaller the benefits as a proportion of income, the smaller their average real income value.

In the second case in Table 5 we use literature-based values of the production-side substitution elasticity of 1.5 in our calculations of the redistributive impact of conditional transfers. In these cases, the additional low-wage labour entering the market substantially depresses wage rates as benefits are eliminated. As shown in Table 6, wage rates fall by 54.4% for the lowest decile, and by 53.9% and 45.8% for the other two deciles. These wage-rate changes inflict big losses on each decile as benefits are eliminated and the ratios of real income change to benefit loss rise.

These later results clearly indicate parameter sensitivity to our results, but they also stress the role that induced wage-rate changes can play when evaluating the effects of benefits schemes. By keeping labour out of the market, for higher substitution elasticities in production these schemes could significantly drive up the wage rates of the poor. Case 2 indicates that this can also be a significant channel for redistributive impact for conditional-transfer schemes.

Taken as set, therefore, the results in Tables 5 and 6 reinforce the earlier observations that the appropriate reference point for the valuation of the benefit of transfers to recipients is their reservation utility in the no-transfer receipt regime; that valuing transfers in terms of cash received overstates their value to recipients; and that induced wage effects can play a key role in evaluating how transfer programmes actually redistribute.

In Table 7 we report on the more extensive parametric sensitivity of our results on the redistributive impact of conditional transfers, focusing on results for the lowest decile. We consider different combinations of demand and production-side elasticities in the model, and report the ratio of the real income to benefit loss and the percentage wage rate change for the lowest model decile. Varying production-side elasticities, large (50%) changes in wage-rate effects occur, and changes of sign occur as the substitution elasticity

TABLE 6
IMPACT OF ELIMINATION OF BENEFIT ON WAGE RATES AND SHARES OF LABOUR INCOME BY DECILE

	New wage	Base wage	New share	Old share
h1	0.147	1.026	0.004	0.008
h2	0.153	0.996	0.006	0.011
h3	0.22	0.92	0.013	0.019
h4	0.299	0.751	0.025	0.031
h5	0.384	0.656	0.044	0.045
h6	0.425	0.588	0.066	0.062
h7	0.445	0.569	0.091	0.082
h8	0.45	0.551	0.117	0.103
h9	0.436	0.505	0.15	0.129
h10	1	1	0.692	0.702

TABLE 7
ELASTICITY SENSITIVITY OF THE REDISTRIBUTIVE IMPACT OF TRANSFERS

Elasticity specification		Ratio of real income loss to poorest decile to their cash benefit loss under benefit elimination			% change in wage rate of the lowest group
Demand side (σ_u)	Production side (σ_p)	10th	9th	8th	
1.6	1.50	0.168	0.15	0.21	– 85
2.05	1.50	0.168	0.15	0.21	– 75
2.50	1.50	0.168	0.15	0.21	– 66
2.95	1.50	0.168	0.15	0.21	– 59
3.40	1.50	0.168	0.15	0.21	– 53
1.6	1.05	0.168	0.15	0.21	17
3.40	1.05	0.168	0.15	0.21	6

moves above or below 1. Correspondingly, ratio values remain around 0.168, and seem to be more robust to the values of substitution elasticities in use. These results thus show substantial parametric sensitivity, but it is concentrated on variation in production-side rather than demand-side parameters. In turn, variations in the ratio of real income loss to benefit loss have corresponding variation in wage-rate changes. Varying demand-side elasticities, while fixing production-side elasticities, has little impact on either ratio or wage rate effects.

The results in Table 7 indicate that substitution elasticities between skill categories on the production side are critical parameters for the evaluation of the actual redistribution achieved by benefit programmes, because of their key role in determining the wage-rate effects involved. Depending upon whether these elasticities are above or below 1, wage-rate effects can be positive or negative, and large wage-rate effects can occur even for relatively modest departures from unity. The literature estimates suggest an elasticity value close to 1.5, implying significant negative wage-rate effects arising from the

TABLE 8
VALUING MARGINAL INCREASES IN TRANSFERS

	Ratio of incremental real income gain to transfer increase for the poorest decile	% wage change under incremental benefit increase for the poorest decile
Central case specification (1.05)	1.0	0.91
High σ_p case (2.0)	1.0	2.88

elimination of transfers or, conversely, significant wage-rate-induced redistribution in favour of low-wage households resulting from transfers. Further empirical research on the appropriate range for this critical parameter is clearly needed to make more definitive statements as to the redistribution actually involved.

Finally, in Table 8 we report the redistributive impacts of a 2% marginal increase in benefit levels. Following the earlier discussion, these have almost equi-proportional effects on real income. In these cases there is also little sensitivity to elasticity values, since wage-rate effects are small. This is because the income effects on leisure consumption from marginal changes in transfers are themselves small.

III. CONCLUSION

This paper builds on the observation that, when evaluating the redistributive effects of transfers, it is the real income equivalent of transfers to recipients that is relevant, and this is typically less than their cash value. This contrasts with current literature, which usually assumes that transfer recipients are better off by the amount of cash they receive. Because of conditionality in transfer programmes, households face a choice between receiving transfers with an accompanying tax-back scheme on additional labour income, and non-participation with no tax-back. The reference point that should be used when evaluating the redistributive effects of transfers is thus the utility level in the no-transfer regime. For a household indifferent between participating and not participating in such programmes, the value of such transfers is zero, even if participation by them involves the receipt of cash. Typically, attaching a tax-back scheme to a transfer mechanism will lower the real value of transfers to the recipient.

We report numerical examples and an empirical implementation of a conditional-choice general equilibrium model based on 2000/02 UK data. Results from both of these clearly show that the conventional belief that, through transfer programmes, transfer recipients are made better off by the full cash transfer received does not hold. For these UK data, our central case conditional-choice general equilibrium model suggests that real gains to transfer recipients in the bottom decile of households may be no more than 87% of cash transfers received. We also show that general equilibrium wage effects from changes in transfer programmes could come into play in a major way, reflecting induced low-wage labour withdrawal attributable to tax-back schemes. These effects further modify the redistribution attributable to transfers. Both of the effects emphasized in this paper appear to have been neglected in the current literature on the evaluation of the redistributive effects of transfer programmes.

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NOTES

1. These transfers are large—Danziger *et al.* (1981) put them at 10% of GDP for the United States—and they play a key role in assessments of the overall redistributive impact of government tax and transfer activity. Browning and Johnson (1984), while admittedly using a broad notion of transfers, suggested that the bottom 25% of households in the United States receive 65% of their income in transfers.
2. Thus, in chapter 6 of Atkinson (1996), where tax benefit models are discussed, a detailed presentation of implicit marginal tax rates implied by complex and overlapping UK schemes appears, but wage rates are treated as exogenous. The same is true of the discussion in Dilnot and Duncan (1992). Yelowitz (1995) also discusses the complex interacting effects of welfare programmes in the United States, displaying their effects on the non-convex budget sets that we emphasize here, but without any welfare analysis of gains and losses and behavioural response under alternative schemes.
3. The closest discussion we are able to find is that by Browning (1973) of the welfare costs of the negative income tax, and the related discussion in Browning and Browning (1987). Browning diagrammatically sets out the regime choice problem we discuss here, he but does not focus on the real value of transfers and offers no numerical or explicit general equilibrium analysis.
4. More complex institutional transfer arrangements can also be modelled. These are captured in a general equilibrium formulation (Rutherford *et al.* 2004), but without the conditional-choice component of the model structure that is at the heart of our analysis here.
5. When combined with existing estimates of the marginal welfare costs of taxes (Browning 1978; Stuart 1984; Ballard *et al.* 1985), which suggests high marginal deadweight losses of taxes and much lower average costs, a picture for the social cost of distortionary tax-financed redistribution in OECD countries also emerges from our analysis. This suggests that the average social cost per dollar of tax-financed redistribution should be revised upward above existing deadweight loss estimates from taxes because of the added distortionary cost from conditionality in transfer schemes; but the marginal social cost per dollar of tax-financed redistribution should be revised downward because of the labour withdrawal low-wage-rate effect. Q3
6. In the UK model presented below we are able to remove wage-rate effects across the various labour types by using substitution elasticities in production close to 1 (constant factor shares). This allows us to isolate the conditionality effects on transfer valuation from the wage effects.
7. $(\overline{L_i} - L_i^e)$is labour supply for household i.
8. Using an alternative labour market treatment would clearly affect results, but would not change the main point of the paper; see Hutton and Roucco (1999) and Böhringer *et al.* (2005) for examples of models with unemployment.
9. The income concept used in the published data is equivalized disposable income.

REFERENCES

ATKINSON, A. B. (1996). *Public Economics in Action: The Lindahl Lectures*. Oxford: Oxford University Press, (first published 1994).

Q2 BALESTRINO, A. (1999). The desirability of in-kind transfers in the presence of distortionary taxes. *Journal of Economic Surveys*, **13**, 333–54.

BALLARD, C. L., FULLERTON, D., SHOVEN, J. B. and WHALLEY, J. (1985). *A General Equilibrium Model for Tax Policy Evaluation*. Chicago: University of Chicago Press.

BENABOU, R. (2002). Tax and education policy in a heterogeneous-agent economy: what levels of redistribution maximize growth and efficiency? *Econometrica*, **70**, 481–517.

BETSON, D. M. and GREENBERG, D. (1986). Labor supply and tax rates: comment. *American Economic Review*, **76**, 551–56.

——— and VAN DER GAAG (1985). Measuring the benefits of income maintenance programs, horizontal equity, uncertainty and economic well-being. *NBER Studies in Income and Wealth*, **50**, 215–33.

BHATTARAI, K. and WHALLEY, J. (1997). Redistribution effects of transfer. National Bureau of Economic Research Working Paper no. 6281.

BLANK, R. M. and RUGGLES, P. (1996). When do women use aid to families with dependent children and food stamps? The dynamics of eligibility versus participation. *Journal of Human Resources*, **31**, 57–89.

Blundell, R., Fry, V. and Walker, I. (1988). Modelling the take-up of means-tested benefits: the case of housing benefits in the United Kingdom. *Economic Journal*, **98**, 58–74.

Böhringer, C. M., Boeters, M. and Feil, M. (2005). Taxation and unemployment: an applied general equilibrium approach. *Economic Modelling*, **22**, 81–108.

Brook, A. K., Kendrick, A. and Meeraus, A. (1992). *GAMS: Users' Guide*, release 2.25. San Francisco: Scientific Press. Q5

Brown, C. V. (1980). *Taxation and the Incentive to Work*. Oxford: Oxford University Press.

Browning, E. K. (1973). Alternative program for income redistribution: NIT and the NWT. *American Economic Review*, **63**, 38–39.

——— and Browning, J. M. (1987). *Public Finance and the Price Systems*, 3rd edn. New York: Macmillan.

——— and Johnson, W. R. (1984). The tradeoffs between equality and efficiency. *Journal of Political Economy*, **92**, 175–203.

Creedy, J. and Kalb, G. (2005). Measuring welfare changes in labour supply models. *The Manchester School*, **73**, 1463–1678.

Danziger, S., Haveman, R. and Plotrick, R. (1981). How income transfers affect work, savings and the income distribution. *Journal of Economic Literature*, **19**, 975–1028.

Dex, S., Clark, A. and Taylor, M. (1995). *Household Labour Supply Employment*. Department Research Series no. 43, ESRC Centre for Micro0social Change, University of Essex.

Dickert, S., Houser, S. and Scholz, J. K. (1995). The earned income tax credit and transfer programs: a study of labour market and program participation. In J. Poterba (ed.), *Tax Policy and the Economy*, vol. 9 Cambridge, Mass.: MIT Press for NBER. Q4

Dilnot, A. and Alan, D. (1992). Lone mothers, family credit and paid work. *Fiscal Studies*, **13**, 1–21.

Dirkse, S. P. and Ferris, M. C. (1995). MCPLIB: a collection of nonlinear mixed complementarity problems. *Optimization Methods and Software*, **5**, 319–45. Q8

Fry, V. and Stark, F. (1987). The take-up of supplementary benefit: gaps in the 'safety net'? *Fiscal Studies*, **8**, 1–14.

Garfinkel, I. and Haveman, R. H. (1977). *Earnings Capacity, Poverty and Inequality*. London: Academic Press.

Greenberg, D. H. (1997). The leisure bias in cost–benefit analyses of employment and training programs. *Journal of Human Resources*, **32**, 413–39.

Hamermesh, D. S. (1993). *Labor Demand*. Princeton, NJ: Princeton University Press.

Hausman, A. J. (1981). Labor supply. In H. J. Aaron and J. A. Pechman (eds.), *How Taxes Affect Economic Behavior*. Washington, DC: Brookings Institution.

Heckman, J. (1974). Shadow prices, market wages and labour supply. *Econometrica*, **42**, 679–94.

Hoynes, H. W. (1993). Welfare transfers in two-parent families: labour supply and welfare participation under AFDC–UP. NBER Working Paper no. 4407, July.

Hutton, J. and Roucco, A. (1999). Tax reform and employment in Europe. *International Tax and Public Finance*, **6**, 263–87.

Killingsworth, M. (1983). *Labour Supply*. Cambridge: Cambridge University Press.

Masters, S. and Garfinkel, I. (1977). *Estimating the Labour Supply Effects of Income-Maintenance Alternatives*. London: Academic Press.

Moffitt, R. (1983). An economic model of welfare stigma. *American Economic Review*, **73**, 1023–35.

——— (1992). Incentive effects of the US welfare system: a review. *Journal of Economic Literature*, **30**, 1–61.

Office of National Statistics (1996, 2001). *Economic Trends*, April, London: HMSO.

——— (2000). *New Earnings Survey*. London: HMSO.

Rutherford, T., Tarr, D. and Shepotylo, O. (2004). Poverty effects of Russia's WTO accession: modelling 'real' households and endogenous productivity effects. World Bank Policy Working Paper no. 3473, January.

Shoven, J. B. and Whalley, J. (1973). General equilibrium with taxes: a computational procedure and an existence proof. *Review of Economic Studies*, **40**, 475–90.

——— and ——— (1992). *Applying General Equilibrium*. Cambridge: Cambridge University Press.

Strauss, J. (1977). Information and participation in public transfer program. *Journal of Public Economics*, **8**, 385–96.

Yelowitz, A. S. (1995). The Medicaid Notch, labor supply and welfare participation: evidence from eligibility expansions. *Quarterly Journal of Economics*, **110**, 909–39.

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